

Exhibit A

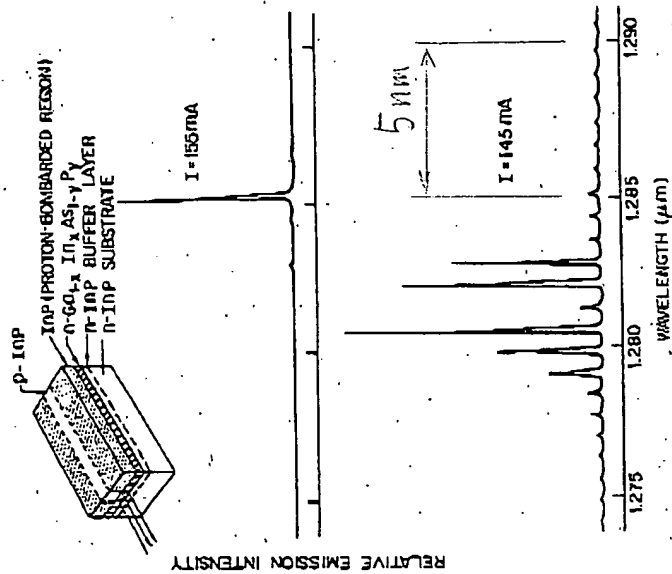


Fig. 50 High-resolution emission spectra for a DH InP-GaInAsP laser. (After Foyl, Ref. 44.)

Figure 50 shows a high-resolution spectral distribution for a proton-bombarded, stripe-geometry, InP-GaInAsP DH laser. At a current just above the threshold (145 mA) quite a few emission lines, about evenly spaced with a separation of $\Delta\lambda \approx 7.5 \text{ \AA}$, exist. At a higher current ($I = 155 \text{ mA}$), there is a strong tendency for the spectrum to become single-lined with only one emission peak near 1.285 \mu m . These emission lines belong to the longitudinal modes that will now be derived. With reference to Fig. 29a, the basic mode selection for the z direction (longitudinal direction) arises from the requirement that only an integral number m of half-wavelengths fits between the reflection planes. Thus

$$m \left(\frac{\lambda}{2\bar{n}} \right) = L \quad (59)$$

$$m\lambda = 2L\bar{n} \quad (60)$$

where \bar{n} is the refractive index in the medium corresponding to the wavelength λ and L is the length of the semiconductor. The separation $\Delta\lambda$ between these allowed modes in the z direction is the difference in the

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